



# **Invasive Plant Species of the Wide Area of the Town of Lukavac as a Threat to Biodiversity**

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## **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## **ABSTRACT**

Invasive plant species are foreign species that usually have a negative impact to the native flora and vegetation, human health, or that cause damage to agriculture and the economy. Therefore, the spread of invasive species is one of the biggest problems in nature protection. The aim of the work is to determine the invasive plant species in the wider area of the city of Lukavac, to analyze the life forms and the geographical origin. The research was done during the summer months of 2021. This paper presents the results of research on invasive plant species in the wider area of the town of Lukavac, which is located in the northeastern part of Bosnia and Herzegovina and administratively belongs to the Federation of Bosnia and Herzegovina and the Tuzla Canton. Total 12 invasive species from 8 families and 12 genera were recorded. The largest number of species belongs to the Asteraceae family, while the other families are represented by one species. Among life forms, therophytes (58, 33%) and phanerophytes (25%) dominate. Geophytes and hemicryptophytes are represented by only one plant species. Recorded invasive plant species come from North America (75%) and Asia (25%).

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## 1. INTRODUCTION

Invasive plant species that come from other biogeographic areas, and in the process competition suppresses autochthonous flora, penetrating into available ecological niches [1]. According to the time when they were introduced to Europe, they can be classified as archaeophytes (which were introduced before 1500) and neophytes (which were introduced after 1500) [2,3].

In addition to the impact on biological diversity, invasive plant species can often have a negative impact on economy, and even human health [4]. Study of the flora of urban environments and their invasive species has intensified recently because of specific plant species that have adapted to high human population density, so that urban flora can be richer than one in the surrounding areas [5]. Invasive species are often reported to have increased competitiveness compared to autochthonous species [6], and lack of natural enemies [7]. Habitat degradation and direct human influence plays a major role in this [8], therefore urban areas are one of the centers where non-native species can easily develop into invasive ones [9].

Numerous literature data are related to the monitoring and control of invasive plant species [10-15]. Invasive species are a separate group of non-native (introduced) plants, which are characterized by high adaptability and rapid spread in new habitats. Invasive species suppress non-native species, change the structure and composition of plant communities, disrupt the stability of the ecosystem and thus directly threaten the native biological diversity [16,17]. The control of invasive species and the mitigation of their impact on native species and habitats is one of the most significant challenges of nature protection.

Lukavac is a small town located in the northeastern part of Bosnia and Herzegovina. Administratively it belongs to the Federation of Bosnia and Herzegovina and Tuzla Canton (Fig. 1). It is located in the valley of the river Spreča. The average altitude is 186 meters, and the area of the town is 320 km<sup>2</sup>.

This area has a moderately continental climate which is characterized by warm wet summers and harsh winters with stronger penetrations of

the Mediterranean climate in the period of June – August. The climate of this area is significantly influenced by the Pannonian Plain in the north and the Dinaric Mountain massif in the south. In the winter period, the Siberian anticyclone has the greatest significance, when this area is exposed to penetration of cold and dry air masses from the north and northeast [18].

The aim of the work is to determine the composition of the invasive flora in the wider area of the city of Lukavac, to analyze the life forms of the recorded invasive plants, and their geographic origin. The results of research should provide a basis for developing a strategy for monitoring the situation and planning measures for suppression of unwanted plant species in order to protect the autochthonous flora.

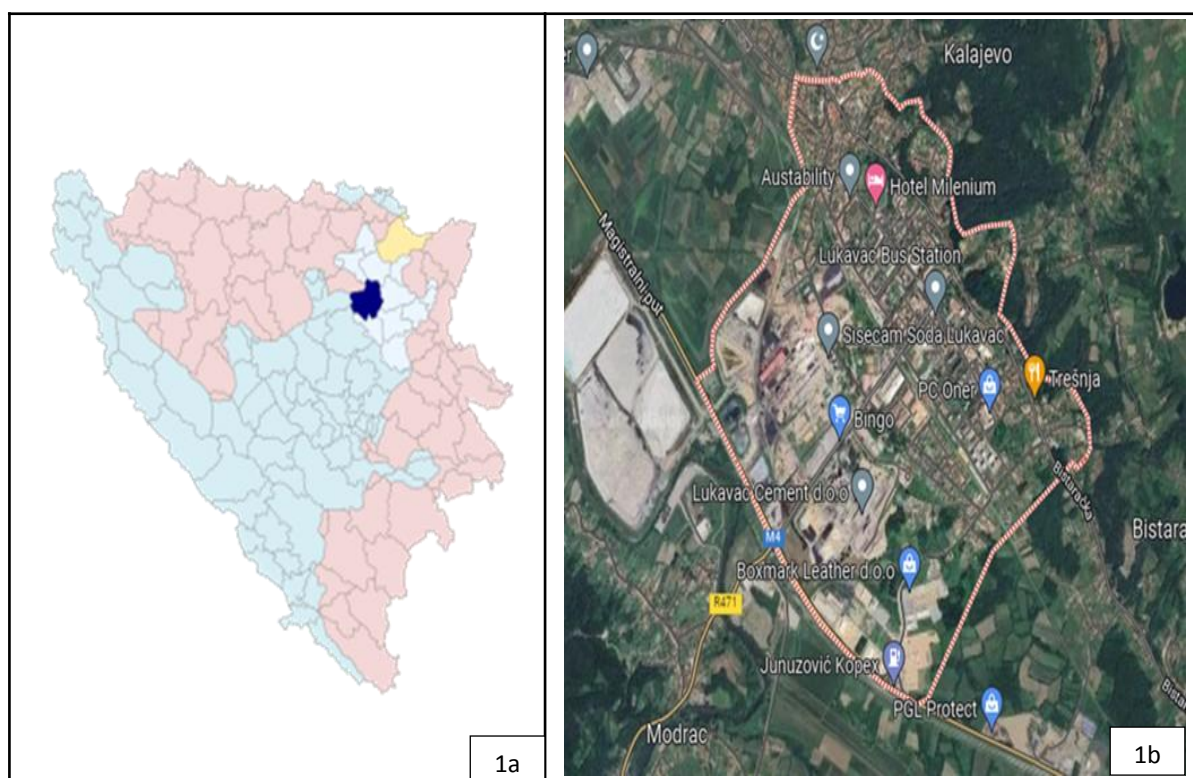
## 2. MATERIALS AND METHODS

Field research was done during the summer months of 2021, in the period when most invasive species are in the optimal stage of development, both for observation in the field and for determination. Field research included: site selection, collection of plant materials and photo documentation in the field. The data was collected at locations spread over the research area, taking into account the diversity of habitats. As a standard, each monitoring site was represented by a 200 m long × 10 m wide transect.

An extensive analysis of the available literary data was carried out, of which the following publications are particularly important for the researched area: Bajić [19] and Beck [20-30].

For species determination, standard keys and iconographies were used: Trinajstić [31], Pignatti [32], Tutin et al. [33,34] Jávorka and Csapody [35] and Domac [36], and the nomenclature is done according to Nikolić [37]. The list of invasive plant species is presented alphabetically by family. Analysis of life forms was determined according to Pignatti [38] using the following abbreviations: Ph – Phanerophyta, H – (Hemicryptophyta), G – Geophyta, T – Therophyta, Hy – Hydrophyta.

The geographical origin of the invasive flora is stated according to Boršić et al. [39] and in doing so the following abbreviations are used: Am-N (North America), As (Asia), As-E (East Asia).



**Fig. 1. Geographical location of the researched area**  
**1a) the geographical position of the municipality of Lukavac in Bosnia and Herzegovina**  
**1 b) research area**

(Source: Google maps application)

### 3. RESULTS AND DISCUSSION

During field research, 12 invasive plants were registered in the researched area species from 8 families and 12 genera (Table 1).

The largest number of determined plant species belongs to the Asteraceae family (5 species; 41,6%), while the other families are represented by only one plant species (Graph 1). The Asteraceae family is also dominant in the foreign flora of Zagreb [40], Sisak [41], Podgorica [42], Mostar [43] and Stolac [14].

Among the life forms, therophytes (7 species; 58.33%) and phanerophytes (3 species; 25%) are dominant. Geophytes and hemi-cryptophytes are represented by only one plant species,

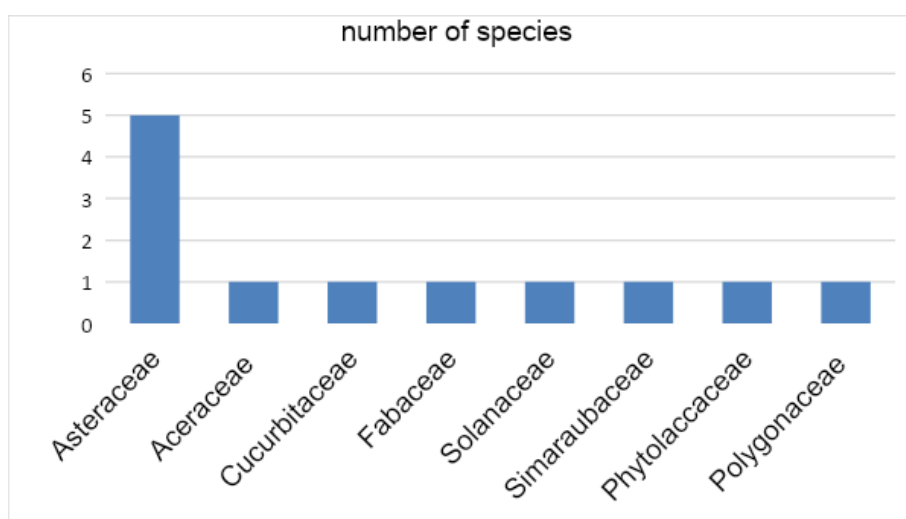
i.e. the share of 8.33%. (Graph 2). A group of researchers [44,39,45,14,15] also emphasize the dominance of therophytes in the analysis of invasive flora.

According to the origin of the invasive plant species in the wider area of Lukavac, they come from the area of America, mainly North America (9 species; 75%) and Asia (3 species; 25%) (graph 3). Boršić et al. [39] state that the percentage of invasive plants introduced from the American territory is 71.9%. However, this is expected due to the similarity of climate characteristics between Europe and the North America [15]. Analysis of the geographical origin of the flora of Sarajevo [46], Podgorica [42] and Mostar [43], showed that the most plants originate from North America and Asia.

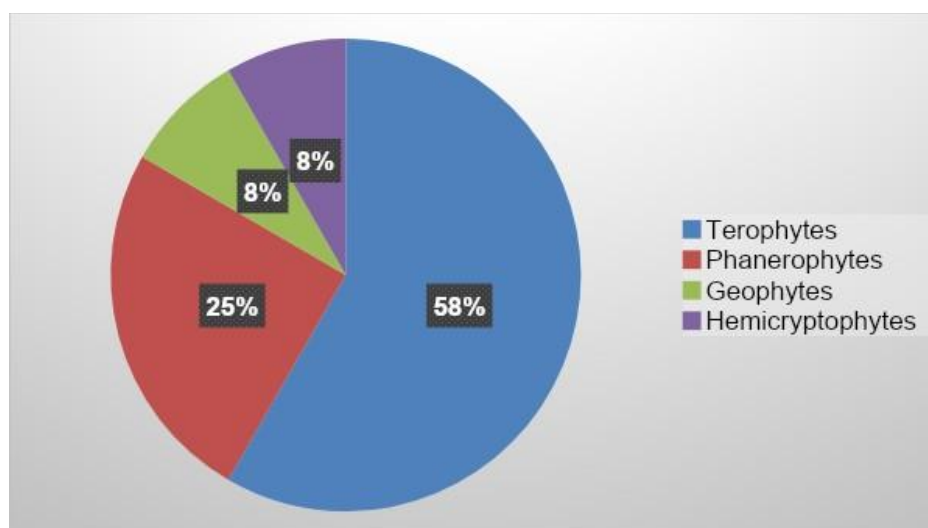
The spread of invasive species in the research area can be expected primarily on areas and habitats that are under greater anthropogenic influence, such as: settlements, then along the edges of roads and paths, arable land, etc. For now, none of the recorded invasive species within the research area was recorded on larger areas and with the high population density.

**Table 1. Overview of invasive plant species in the wider area of the city of Lukavac**

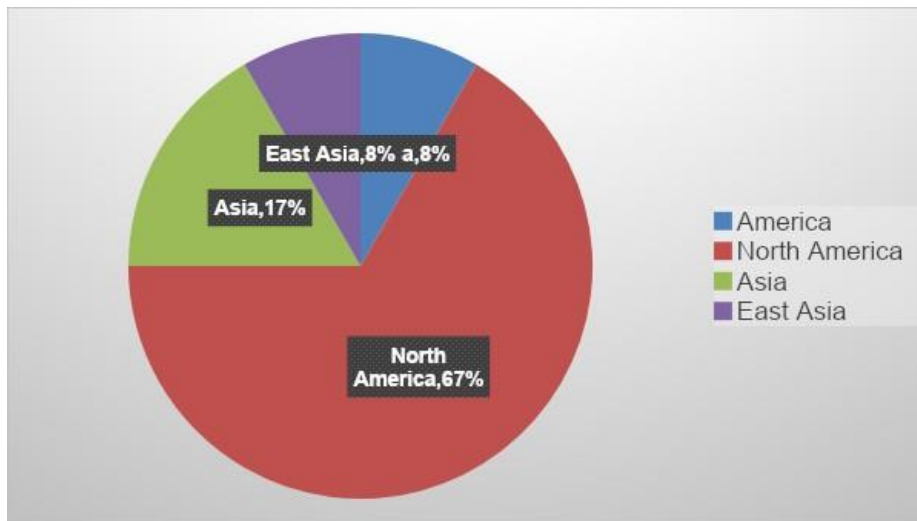
Latin name	Family	Origin	Life form
<i>Ailanthus altissima</i> (Mill.) Swingle	Simaroubaceae	As-E	Ph
<i>Acer negundo</i> L.	Aceraceae	Am	Ph
<i>Ambrosia artemisifolia</i> L.	Asteraceae	Am-N	T
<i>Artemisia verlotiorum</i> Lamotte	Asteraceae	As	T
<i>Datura stramonium</i> L.	Solanaceae	Am-N	T
<i>Echinocystis lobata</i> (Michx.) Torr. & A. Gray	Cucurbitaceae	Am-N	T
<i>Erigeron annuus</i> L. Desf.	Asteraceae	Am-N	T
<i>Helianthus tuberosus</i> L.	Asteraceae	Am-N	G
<i>Phytolacca americana</i> L.	Phytolaccaceae	Am-N	H
<i>Reynoutria japonica</i> Houtt.	Polygonaceae	As	T
<i>Robinia pseudoacacia</i> L.	Fabaceae	Am-N	Ph
<i>Solidago gigantea</i> Aiton, Hort. Kew.	Asteraceae	Am-N	T



**Graph 1. Representation of families among invasive species in the wider area of the town of Lukavac**



**Graph 2. Spectrum of life forms of invasive flora in the wider area of Lukavac**



**Graph 3. Origin of invasive species in the researched area**

#### 4. CONCLUSION

Based on the results of the research, the following conclusions were reached:

- 12 invasive plant species from 8 families were determined in the investigated localities and 12 genera. The largest number of species belongs to the Asteraceae family (41, 6%), while the rest families represented by one plant species.
- Among life forms, therophytes (7 species; 58,33%) and phanerophytes (3 species; 25%) dominate. Geophytes and hemicryptophytes are represented by only one plant species, ie with a share of 8.33%.
- According to the origin of the invasive plant species in the Lukavac area, they come from the area of North America (9 species; 75%) and Asia (3 species; 25%).

Careful and responsible management of the natural resource will allow the number of invasive plants to decrease species maintain at the existing level. High rate of biotic homogenization in urban areas points to the need to conserve biodiversity, even in habitats that are strongly transformed by human.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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